INDIAN SUSTAINABLE ENERGY NEWS

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IN THIS ISSUE

Indian Sustainable Energy News is a publication of the Native American Renewable Energy Education Project

TRIBAL PERSPECTIVE

Zunis Turn to the Sun

The Zuni Tribe in western New Mexico is turning to the sun to help meet their water needs. The Tribe is developing a program to replace broken water-pumping windmills with less expensive solar water pumps—and at the same time is working to address difficult questions of who should pay for, own, and maintain remote water pumping equipment.

Water...can't live without it

"For us, sheep herding and dryland farming is a way of life," explains Wilbur Haskie, supervisory director of the Range Group of the Zuni Conservation Project, (ZCP) and one of the founders of the Zuni Sustainable Energy Project (ZSEP). Haskie continues, "We grow beans, corn, melons, and squash - and the sheep that we raise provides meat, wool, and are important in our religious traditions. But we need water... Water is critical for the Zuni."

With historic reductions in the quality and quantity of the Zuni land base, availability of water has become crucial for the viability of traditional farming and ranching. Starting in the 1930s, the Bureau of Indian Affairs (BIA) installed 64 water pumping windmills to serve remote ranchers and farmers on Zuni.

In the late 1970s, maintenance and repair of these windmills became too expensive for the BIA, and responsibility and ownership of the windmills was turned

Continued

DARREN SANCHEZ

The Zuni Sustainable Energy Project performs maintenance on existing wind mills, and has fixed those that are still cost-effective to repair.

over to the Tribe. The Tribe also lacks funds for windmill repair, and currently only 21 of the original 64 are operational. Because water pumping windmills are no longer mass-produced in the numbers common in the early part of this century, fixing or replacing windmills can be very expensive.

"We've catalogued the condition of all the windmills on Zuni", says Haskie, pointing to photos of windmills pinned to a topographical map that covers one wall of his office, "and we've worked with ranchers and farmers to fix all the windmills that require less than $500 in new parts. But for the rest, we think solar [water pumping] is the way to go".

With the breakdown of windmills, many Zuni ranchers and farmers currently haul water for agriculture and livestock using their pickup trucks. It is not uncommon for a Zuni rancher to make several trips a week, driving 30 miles one-way over rough four-wheel-drive roads, pulling a water tank weighing two tons. Fuel for these trucks costs a typical Zuni farmer or rancher $1,000 per year. In this type of service, trucks require frequent repairs, especially brakes, clutches, and tires.

A Zuni rancher watches solar pumped water at Jimmy Pewa's sheep camp.

CHRIS GREACEN

Zuni Solar Water Pumping

A visit in 1995 to a renewable energy symposium hosted by Hopi Native Sun, a Hopi/Navajo solar electric tribal enterprise on the Hopi Reservation in Arizona, got Haskie and other ZCP staff, Darren Sanchez and Andy Laahty, excited about applications of renewable energy for the Zuni reservation. Inspired by the visit, the Zunis organized the first Zuni Sun Day in the summer of 1996. The demonstration included a workshop led by solar water pumping expert Windy Dankoff. The ZCP staff were impressed with the solar water pumping demonstration and purchased a submersible solar pump, controller, and two 50-watt solar panels. They adapted a surplus Geographic Information System (GIS) digitizing stand to make a sturdy rack for the solar panels that could be lifted in and out of the project's pickup trucks.

The solar pumping system cost $1,300 and provides 1.5 gallons per minute from a depth of 230 feet. On a sunny day this amounts to 900 gallons per day, enough water for approximately 200 sheep or 35 cattle. The ZCP found other uses of solar energy as well: Andy Lhaaty and the Zuni Sustainable Agriculture Project built a solar electric system to power equipment in a greeenhouse, and the hydrology department of the ZCP used solar power for a reservation-wide flood warning system.

In the course of their duties as Zuni Conservation Project range technicians, Haskie and Sanchez have been bringing the solar water pumping system with them to dozens of remote sheep camps, stock tanks, and spring developments to demonstrate the technology to rural ranchers and farmers. As a result of their outreach efforts, two Zuni farmers have installed solar pumps and more have expressed interest.

Working with the Native American Renewable Energy Education Project, in 1997 Haskie and Sanchez formalized their renewable energy promotion work to form the Zuni Sustainable Energy Project (ZSEP). ZSEP has demonstrated a variety of solar energy technologies at community events, schools, and to Zuni leaders as well as farmers and ranchers. In addition to solar water pumps, the project designed a number of solar electric systems to power lights and small household appliances in remote sheep herding camps.

With a grant from the Greenville Foundation, ZSEP purchased a demonstration solar pumping system using a surface pump—a less expensive option than submersible pumps for pumping applications such as spring developments where the water level is close to the surface. Haskie, Sanchez, and others also participated in several training sessions that increased their capability to design, install and maintain solar water pumping systems.

The Next Steps

At $1,000 to $2,000 each, the Tribe doesn't have the money to install solar water pumps to replace the 43 broken windmills. Nor does it want to repeat an historic pattern of assuming responsibility for ownership and maintenance of solar water pumps. The Tribe feels that the systems should be the responsibility of those who benefit from them. However, ZSEP works in conjunction with NAREEP and Hopi Native Sun to lower barriers to Zunis purchasing these systems. Hopi Native Sun is a Native-American-run renewable energy company in Kykotsmovi, Arizona. With training from NAREEP and Hopi Native Sun, ZSEP provides engineering services to design and install the systems, and free skilled labor for maintenance. Hopi Native Sun and other vendors will provide access to below-retail cost renewable energy equipment. And Hopi Native Sun and the Zuni Tribe will help provide the infrastructure for financing and Tribal Employee payroll deductions to facilitate payments for the systems.

WILBUR HASKIE

Zuni wind pumps that are beyond repair are being replaced by solar pumping systems.

Because this arrangement will require that tribal members pay for these systems - when historically the BIA or the Tribe provided the water pumping wind mills - adoption of solar water pumping is expected to be slower than it would be if the systems were installed under a large tribal purchase. But this approach economizes on the Tribe's limited economic resources, and is expected to lead to the program being much more sustainable since the water pumping systems will be the responsibility of those who benefit most from them. Because solar water pumping is less expensive than hauling water in trucks, Zuni ranchers and farmers should benefit most of all in reduced expenses for maintaining their herds and irrigating remote gardens.

"We're getting the word out there, and they're slowly catching on," says Andy Lhaaty, "You come back in a couple years, and I'll bet you'll see a lot of us Zunis using these solar systems. They save money—whether it's money for hauling water, or money spent on batteries and white gas for lighting."

ZSEP is betting that their education efforts will pay off and more Zunis will turn to the sun to improve the viability of traditional ranching and sheep herding.

[If you're in Zuniland, drop by the Zuni Conservation Project offices in the fair grounds and ask for Wilbur or Darren. If they haven't left for the field they'll show you some of the solar equipment they're working with.]

—*Chris Greacen*

RESOURCES

FEDERAL INFORMATION SOURCES

The Energy Efficiency and Renewable Energy Clearing House (EREC) has fact sheets on solar water pumping. Call EREC at 1-800-DOE-EREC (363-3732), or contact the Consumer Energy Information homepage at www.eren.doe.gov/consumerinfo/. EREC has staff that can help answer any question related to renewable energy or energy efficiency.

BOOKS AND MAGAZINES

Home Power Magazine. A practical hands-on journal of renewable energy, with frequent articles on solar water pumping. P.O. Box 520 Ashland, OR 97520. 800-707-6585. www.homepower.org

Water Pumping: The Solar Alternative, Michael G. Thomas, Photovoltaic Systems Design Assistance Center, Sandia National Laboratories, SAND87-0804, 1992.

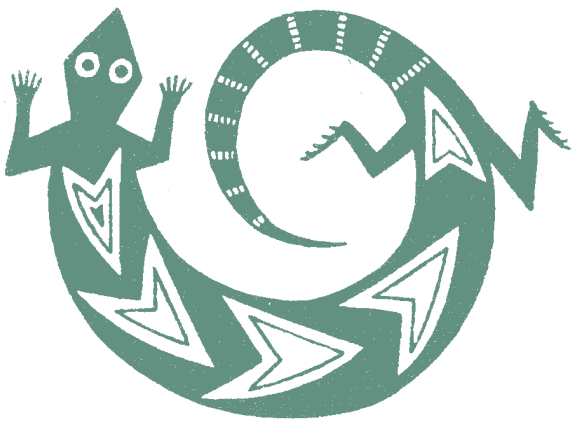
TRIBES PURSUING SOLAR WATER PUMPING PROJECTS

Hopi Native Sun (Hopi & Navajo), P.O. Box 660, Kykotsmovi, AZ 86039, 520-734-2556

Hualapai Tribe, P.O. Box 300, Peach Springs, AZ 86434, 520-769-2255

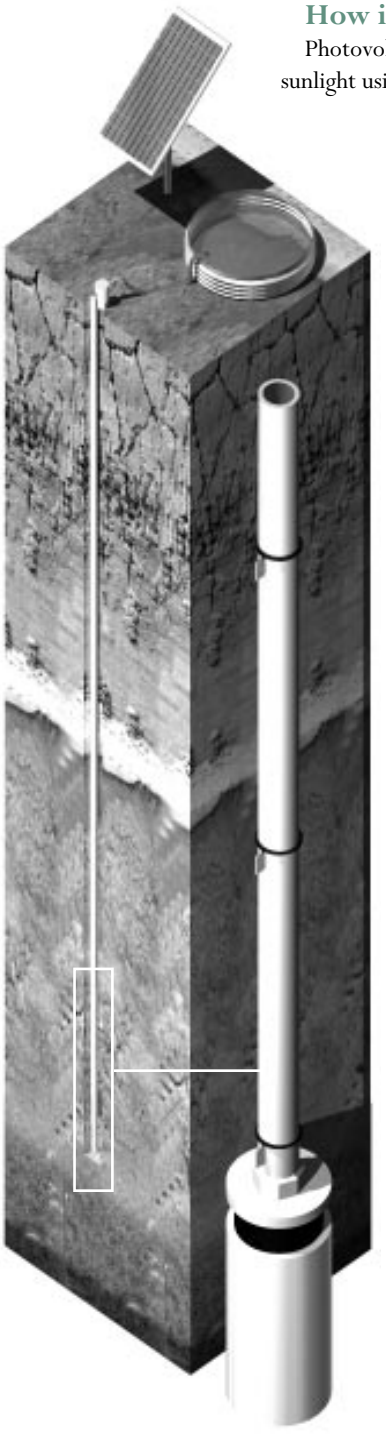
Ute Mountain Ute, P.O. Box 52, Towaoc, CO 91334, 970-565-3751

Zuni Tribe, Zuni Conservation Project, P.O. Box 339, Zuni, NM 87327, 505-782-5852



Solar Water Pumping

If you need to supply water beyond the reach of power lines, then solar power can help solve the problem. Photovoltaic powered pumps provide a welcome alternative to fuel-burning engines and hand pumps. Thousands of solar pumps are working throughout the world. They produce best during sunny weather, when the need for water is greatest.



Cut-away view of a solar-powered water pump providing water for livestock, with an expanded view detailing the submersible pump.

How it works

Photovoltaic (PV) panels produce electricity from sunlight using silicon cells, with no moving parts. They have been mass-produced since 1979. They are reliable enough that most manufacturers give a ten-year or greater warranty, and a life expectancy of 20 years or more. They work well in cold or hot weather.

Solar water pumps are specially designed to utilize direct current (DC) electric power from PV panels. They must work during low light conditions at reduced power, without stalling or overheating. Low volume pumps use positive displacement (volumetric) mechanisms which seal water in cavities and force it upward. Lift capacity is maintained even while pumping slowly. These mechanisms include diaphragm, vane and piston pumps. These differ from conventional centrifugal pumps that need to spin fast to work efficiently. Centrifugal pumps are used where higher volumes are required.

A surface pump is one that is mounted at ground level. A submersible pump is one that is lowered into the water. Most deep wells use submersible pumps. A controller or current booster is an electronic device used with most solar pumps. It acts like an automatic transmission, helping the pumps start and not to stall in weak sunlight.

A solar tracker may be used to tilt the PV array as the sun moves across the sky. This increases daily energy gain by as much as 55 percent. With more hours of peak sun, a smaller pump and power system may be used, thus reducing overall cost. Tracking works best in clear sunny weather and in locations with horizon-to-horizon sunlight. It is less effective in cloudy climates and on short winter days, or where obstacles limit the number of hours of direct sun.

Storage is important. Three to ten days of storage may be required, depending on climate and water usage. Most systems use water storage rather than batteries, for simplicity and reliability. A level sensor can turn the pump off when the water tank fills, to prevent overflow. A similar control can turn the pump off if the water source is drawn too low.

Compared with windmills, solar water pumps are less expensive, and much easier to install and maintain. They provide a more consistent supply of water. They can be installed in valleys and wooded areas where wind exposure is poor. A PV array may be placed some distance away from the pump itself, up to several hundred feet away.

What it is used for

Lifestock Watering: Cattle and sheep ranchers on the Ute, Navajo, Zuni, and Hualapai Reservations — as well as many others in North America, Mexico, and Australia are enthusiastic solar pump users. Their water sources are scattered over vast rangeland where power lines are few, and costs of transport and maintenance are high. Some ranchers use solar pumps to distribute water through several miles of pipelines. Others use portable systems, moving them from one water source to another. Solar pumps are also used to protect streams and ponds by pumping to troughs away from fragile aquatic ecosystems.

Irrigation: Solar pumps are used on small farms, orchards, vineyards and gardens. It is most economical to pump PV array-direct (without battery), store water in a tank, and distribute it by gravity flow. Where pressurizing is required, storage batteries stabilize the voltage for consistent flow and distribution, and may eliminate the need for a storage tank.

Aquaculture: Solar pumps are used for aeration, or to provide circulation in ponds to prevent eutrophication and icing.

Domestic Water: Solar pumps are used for private homes, villages, medical clinics, etc. A water pump can be powered by its own PV array, or by a main system that powers lights and appliances. In a combined system, more configurations are possible. An elevated storage tank may be used, or a second pump called a booster pump can provide water pressure. Or, the main battery

A CAREFUL DESIGN APPROACH

PV panels are expensive, so we must size our system carefully. It is like fitting a suit of clothes: you need all the measurements. Here is a guide to the data that you will need to determine feasibility, to design a system, or to request a quote from a supplier.

STEP 1. DESCRIBE WATER REQUIREMENTS

Typical daily water requirements
People: 10 to 100 gallons per person per day, depending on lifestyle and conservation measures
Cattle: 10-30 gallons per day in dry weather
Small Animals: 1/4 gallon per day per 25 lb. body weight
Poultry: 6 to 12 gallons per hundred birds per day
Young Trees: 15 gallons per day in dry weather
— These figures will vary with local conditions —

- Amount needed: (e.g., 100 gallon per day average)
- Uses: (home? irrigation? livestock?)
- Variation in water requirements: (e.g., 50 gallons per day in January, 300 gallons per day in July)
- Will the solar pump be the only source of water? If not, what percentage of the supply will it provide?

STEP 2. DESCRIBE THE WATER SOURCE

If it is a deep well:

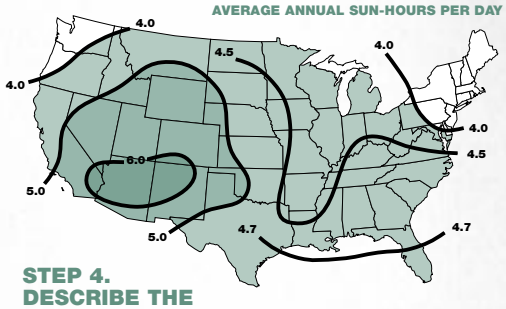
- Well depth
- Depth to water
- Recovery (production) rate (gallons/minute or day)
- Additional vertical lift required to an elevated tank or up a hill
- Horizontal distance from the source to the point of storage or delivery

If the water is less than 20 feet below the surface:

- Describe the source (e.g., pond, spring)
- Vertical lift required to the tank location
- Horizontal distance from the source to the point of storage or delivery

STEP 3. DESCRIBE ANY EXISTING EQUIPMENT

- Is a working pump already in place? (Describe)
- A storage tank?
- A pipeline? (State length and diameter)
- Is there commercial power available at the site? How far away? (Solar pumping may not be cost-competitive with existing utility service.)



STEP 4. DESCRIBE THE SOLAR ENERGY AVAILABLE AT THE SITE

- How many sun-hours are available per day? Use a solar map showing average insolation, such as the one on this page. If you need to pump most in the winter time, use a map that shows winter sun hours. This can be derived from databases and maps available from a variety of sources.
- Note whether there are any obstructions to direct sunlight at the site.
- Note if there are any local variations from the regional climate, (ie. coastal fog).

STEP 5. DETERMINE WHAT KIND OF PUMP YOU NEED

This is based on the nature of the water source. Submersible pumps are suited both to deep well (borehole) and to surface water sources. Surface pumps can only draw water from about 20 feet (3m) below ground level, but they can push it far uphill. They are less expensive than submersibles and a greater variety is available.

STEP 6. DETERMINE THE FLOW RATE REQUIRED

Here is the equation, in the simplest terms: Gallons Per Day / Available Peak Sun Hours per day=Gallons per Hour (for example, 600 gallons per day/10 peak sun hours=60 gallons/hour)

STEP 7. IDENTIFY APPROPRIATE PUMP AND SOLAR ARRAY

Refer to the performance charts published by solar pump manufacturers who produce the type of pump that is appropriate. They will specify the size and configuration (voltage) of solar array necessary to run the pump.

system can provide storage instead of a tank. Rain catchment can supplement solar pumping, when sunshine is scarce. To design a system, it helps to view the whole picture, and consider all the resources. Solar water pumps are often part of low-power remote water purification or water treatment systems, using ultraviolet light or chlorine to make water safe to drink. (See News Briefs on page seven for more information about ultraviolet (uv) water purification).

Thinking Small

There are no limits to how large solar pumps can be built. But they tend to be most competitive in small installations where combustion engines are least economical. The smallest solar pumps require less than 150 watts, and can lift water from depths exceeding 200 Feet (65 m) at 1.5 gallons (5.7 liters) per minute. You may be surprised by the performance of such a small system. In a 10-hour sunny day it can lift 900 gallons (3,400 liters). That's enough to supply several families, 30 head of cattle, or 40 fruit trees!

Slow solar pumping lets us utilize low-yield water sources. It also reduces the cost of long pipelines, since small-sized pipe may be used. The length of piping has little bearing on the energy required to pump, so water can be pushed over great distances at low cost. Small solar pumps may be installed without heavy equipment or special skills.

The most effective way to minimize the cost of solar water pumping is to minimize water demand through conservation. Drip irrigation, for example, may reduce consumption to less than half that of sprinkler irrigation. In homes, low flow toilets can reduce total domestic use by half. Water efficiency is a primary consideration in solar pumping economics.

—Windy Dankoff and Chris Greacen

Contact Chris Greacen at NAREEP or Windy Dankoff at 505-473-3800; email: pumps@danksolar.com; website: www.dankoffsolar.com.

Clay Bravo of the Hualapai Tribe

DON BAY

Clay Bravo, assistant director of the Natural Resources Department of the Hualapai Tribe has been working for six years to build what may be the world's largest solar water pumping project. Through the power of one great Hualapai resource, sunlight, the Hualapai are pumping water to another great resource, the Grand Canyon. With water at the Canyon rim, they will be able to develop a tourist enterprise that will bring income to the tribe, as well as deliver water to livestock and wildlife in the western half of the reservation.

Could you describe the history of the Hualapai solar water pumping project?

CB: The Hualapai Tribe has a tourist enterprise on the southwest edge of the Grand Canyon, "Grand Canyon West." Currently it is small, providing Hualapai-led tours of this end of the Canyon. The Hualapai wanted to expand this enterprise to become more economically self-sufficient, but we were limited by water. All potable water must be trucked in. The only ground - or surface - water was deep, three thousand feet down. To serve this tribal enterprise, we would eventually need 70 gallons of water/minute. The tribe starting thinking, what else can we do to get water out to the resort? I thought that maybe we could capture power from the sun to pump water from shallow aquifers 25 miles to the east.

How did you go from that first idea to the place where you are laying pipe and installing solar arrays?

CB: We talked to engineering and pumping firms to learn whether our idea might work. Then we started looking for funding. One of our goals was to not draw down the Hualapai General Fund, so we needed to find funding before proceeding with our plans. We received early funding from the Bureau of Reclamation, Drought Relief Program, the BIA Water Resources Program 638 for planning, and the Department of Energy, Title 26, for a pilot project. Finally, for this last leg, we have a 70/30 grant loan from the Department of Agricultural Rural Economic Development Program. This grant/loan of $390,000, is 70% grant, and 30% loan, which the Hualapai will pay back over 40 years. We also are receiving funds from the EPA and the Arizona Department of Water Quality to monitor the effects of water pumping on the watershed. We want to make sure that we are pumping water at a rate that is sustainable for the ecosystem.

What was the total cost of the project?

CB: The project costs come to $1,200,000. Operation and maintenance costs are much lower for solar water pumping than for diesel pumps or bringing in utility lines.

Could you describe the system?

CB: The well is about 500 feet deep and pumps 28 gallons/minute, and the pipeline is 26.5 miles long. There are solar arrays that track the sun at the well and at five relay stations along the pipeline. Each of the relay stations has a 5000 gallon storage tank. We will begin building a 250,000 gallon storage tank at the end of the line next week. Right now, we are testing the lines for leaks before we bury them. This project has been a Hualapai dream. After six years of planning and work, we should be filling the tank at the end of the line by April.

How many solar panels does it take to power the well pump and send the water to Grand Canyon West?

CB: The submersible pump in the well is powered by 12 panels of 70-watts each. Then the water is pumped up a mountain to a large holding tank. This is powered by 144 80-watt panels. The relay stations each have arrays of between 48 and 60 panels of 80-watts each. In all, we have installed 372 solar modules for a total of 29,640 watts.

What about the 70 gallons/minute that you project needing at Grand Canyon West?

CB: For now the 28 gallons/minute meets our needs, but we are looking at drilling a deep well closer to the resort in the future to provide for future needs.

Does the system provide water to any sites other than the resort?

CB: Yes, it is already being used to provide water for the Hualapai cattle herd and for wildlife. Lateral lines feed off the main pipeline to drinking troughs. The water is also available to any tribal members who want to move into the western half of the reservation and tap into the line to get potable drinking water.

How will you operate and maintain the system?

CB: Two of our tribal employees were trained by the pump and solar installers during the installation process. Also, it's important to note that Hualapai have been very involved in the project, building the pipeline and tanks, and assisting with installation.

Are there any other ways the tribe is using solar power or other renewables?

CB: Yes, there are three other solar powered water pumps and one windmill serving livestock on the reservation. The resort uses a hybrid wind/PV system for electricity, and the tribe built an earthship with an EPA grant, using tires, earth, and solar power.

Do you have any suggestions for anyone contemplating a solar water project?

CB: My advice is to do it. The initial cost is high but it's worth it in the long run. The sun is free and the power is clean.

Clay Bravo can be reached at 520-769-2255, Fax: 520-769-2309; Department of Natural Resources, Hualapai Tribe, P.O. Box 300, Peach Springs, AZ 86434

—Vivian Gratton

PV Solar Certification

Certified system designers and installers will have an edge when it comes to getting jobs, putting up and repairing PV systems. Tribal colleges will be lead sites for PV solar installer certification training and testing. The tribal college certification program is being developed by the Institute for Sustainable Power, along with NAREEP, and tribal colleges with renewable energy training programs. Funding from the Department of Energy will support development of the program over the next year. Please contact Vivian Gratton if you are interested in learning more about this newly funded program. (831-459-8942; fax 831-454-9739; vgratton@cruzio.com)

Grants for Economic Development

The Commerce Department's Economic Development Administration (EDA) invites application for projects to alleviate persistent unemployment and underemployment in economically-distressed areas and joblessness resulting from sudden economic dislocations. Project areas of interest include but are not limited to: the commercialization and deployment of new environmental technologies and techniques (e.g., innovative material recycling or reuses, pollution control or treatment processes, and flood mitigation), sustainable development (e.g., diversification of natural resource dependent economies, eco-industrial parks, aquaculture facilities, and brownfields' redevelopment); projects that support the economic development of Native American communities including Alaska Native Villages. Regionally focussed solutions will be given priority over proposals that are more limited in scope. $248,796,000 is available through 6/15/99. For more info and a list of EDA contacts, go to the Federal Register notice or to: http://www.doc.gov/eda/html/specinfo.htm. (Federal Register 2/24/99)

Ultraviolet-light water purification

If you have water quality concerns on your tribal lands, ultraviolet light water purification may be the way to go. Currently being used in remote villages around the world, particularly in Honduras after the hurricane, the technology requires little power to do a very important job. One or two 45-watt solar panels can power the purification of enough drinking water for several thousand people. Smaller units for individual or household uses are powered by small solar panels, or can be wired to other electric sources.

(For more information contact: Aqua Sun International 775-265-7725, fax 775-265-3985, info@aqua-sun-intl.com)

Northwest Indian Tribes Involved in Utility Deregulation Process

The Affiliated Tribes of Northwest Indians Economic Development Corporation (ATNI-EDC) is responding to the changing electric industry by developing a Tribal Energy Program. This program supports true self determination by involving Northwest Indian Tribes in the electric utility deregulation process.

The ATNI-EDC wants to ensure that Northwest Tribes have a solid foundation for making informed decisions about energy deregulation opportunities. To this end, the ATNI-EDC has formed a partnership with the Bonneville Power Administration. This partnership will allow the Tribes access to the technical expertise at the Bonneville Power Administration and to other state, federal, and regional entities.

Each Tribe has a distinct vision of the economic, environmental and cultural issues that guide and protect the political sovereignty of their Tribe. The Energy Program was designed to assist Tribal leadership in making more informed decisions regarding the ways that regional utility deregulation affects their own Tribe. Some of the questions that Tribes will address include: What roles can Tribes play as the electric utility deregulation unfolds? What are the effects deregulation will bring to tribal natural resources? What are the challenges of entering a changing market?

For more information about the ATNI-EDC Energy Program, contact Sonya Tetnowski at 425-774-5419, fax 425-774-5927, sonyamt@premier1.net.

INDIAN SUSTAINABLE ENERGY NEWS

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Please call NAREEP if you are interested in doing an energy effeciency or renewable energy project.

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NEWS FROM NAREEP

Christine Deadrich, a UC Berkeley senior with a double major in Physics and Native American Studies, and with heritage in the Sak and Fox tribe, recently joined NAREEP. She helps with the NAREEP Clearinghouse and is interested in working on education projects with tribes.

John Elliott has begun working with the **Yurok Tribe** to institutionalize plans for improving the efficiency of housing and community buildings on the Yurok reservation. John also continues work with the **Rosebud Sioux Tribe**, where the next planned project he will be involved in is an audit and retrofit at the tribe's hotel, convention center and casino.

Vivian Gratton, John Elliott, and **John Busch** have been recruiting Native American undergraduate and tribal/community college students to apply for internships to work on sustainable energy projects with NAREEP for the summer of 1999 and during the following fall and spring semesters. Contact the NAREEP office for details on this opportunity (and please hurry if you are thinking about applying for the summer 1999 positions).

Erika Walther completed her half-year stint on the Zuni Reservation this past winter where she focused on identifying financing options for small-scale renewable projects being offered through the tribe's **Zuni Sustainable Energy Project**. "Fact Sheets" on cash purchase, term-financing, and fee-for-service types of financing applicable to sustainable energy projects on reservations are available for the asking from NAREEP.

Chris Greacen also spent a few weeks at the Zuni Reservation over the holidays assisting ZSEP. He helped on one solar home system installation at a sheep camp, on developing an equipment list for the project, and on writing up rental agreement documents based on Erika's work. Chris introduced a solar home system that is commonly used in Nepal which seems appropriate for sheep camp applications in Zuni because it's inexpensive and eliminates some of the unsightly wiring that assembling systems from individual components (charge controllers, etc.) requires.

The **Affiliated Tribes of Northwest Indians** and the **Bonneville Power Administration's** Tribal Liaisons and Energy Efficiency staff have been in regular dialogue with John Busch, **Tom Starrs**, and Chris Greacen about pursuing sustainable energy projects among the 50 member tribes. ATNI Energy Coordinator, **Sonja Tetnowski** is leading the charge by organizing workshops, overseeing the development of electricity profiles for interested member tribes, and coordinating energy project proposals. (See News Briefs for more on ATNI's activities.)

Upcoming Issues of Indian Sustainable Energy News

Summer Solstice 1999
Financing Tribal Sustainable Energy Projects

Fall Equinox 1999
Tribes and Utilities

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